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RE: draft amendement for Interview

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COMMENTS:

DRAFT

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:

Fushiki et al.

Serial No. 09/384,141

Filed: August 27, 1999

For: VISUALLY ERROR-FREE COLOR IMAGE REPRESENTATION

Group Art Unit: 2623

Examiner: C. LaRose

Atty. Dkt. No. 003797.81834

RESPONSE AND AMENDMENT

The Honorable Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Responsive to the Official Action dated April 4, 2002, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Please replace the paragraph beginning on page 3, line 22 with the following:

–The present invention provides an apparatus, method and computer-readable medium for converting digital signals for a color image into high quality error-free expanded color spacc color images. A normalized RGB color space is defined for color values from 0 to 1. An expanded RGB or an expanded RGBA or expanded sRGB or an expanded sRGBA color space is defined herein to include color values below 0 and/or greatcr than 1. By extending the color space, the present invention eliminates the need for users to "clamp" color information into the predetermined range than are needed to fully describe the color. For example, where color data

information is limited to an-8 bit range of 0 to 255, and a color value of 300 is obtained, data may be "clamped" into the range of 0 to 255, causing color data loss and distortion.--

Please replace the paragraph beginning on page 4, line 8 with the following:

--In one embodiment, the method includes obtaining color values; mapping the color values to one of: an expanded RGB or an expanded RGBA or an expanded sRGB or an expanded sRGBA space; and labeling an image determined by mapped color values as an expanded RGB/RGBA or expanded sRGB/sRGBA color space image. The expanded RGB or the expanded RGBA or sRGB or SRGBA space may include at least the visible range of color values. Also, the expanded RGB or the expanded RGBA or sRGB or SRGBA space may be described as a color space defined by a chromaticity diagram that extends into negative component values and beyond 1.0 when normalized to 1.0 in RGB or sRGB, respectively. With respect to terminology, as used herein, "RGB/RGBA" is defined to be interchangeable with the terms "RGB or ARGB" or "RGB or RGB(A)". That is, there is no distinction between the recited terms, and no specific ordering of elements is indicated by the terminology. Further, as used herein, "RGB/RGBA" is to be interpreted as RGB or RGBA; expanded RGB/RGBA" is to be interpreted as expanded RGB or expanded RGBA; and "expanded SRGB/SRGBA" is to be interpreted as expanded SRGB or expanded SRGBA. In the alternative, any of the above terms may be expressed and interpreted as "one of x or y". For example, "expanded RGB/RGBA" may be equivalently expressed as "one of an expanded RGB and an expanded RGBA."

Please replace the paragraph beginning on page 19, line 10 with the following:

--3. Image convolution operations. For example, a blur filter matrix M is given by:

1/16	1/8	1/16
1/8	1/4	1/8
1/16	1/8	1/16

The blur equation is for each color component. Assuming a RGB color component of a pixel at location (i, j) is C(i,j), the resulting RGB color component of the pixel after the blur operation is given by:

$$(1/16)C(i-1, j-1) + (1/8)C(i-1, j) + (1/16)C(i-1, j+1) +$$

$$(1/8)C(i, j-1) + (1/4)C(i,j) + (1/8)C(i, j+1) +$$

$$(1/16)C(i+1, j-1) + (1/8)C(i+1, j) + (1/16)C(i+1, j+1)--$$

IN THE CLAIMS:

Please amend the following claims:

1. (Amended) A method for providing a color space representation of color images in a color management system, comprising the steps of:

mapping color to color data values in one of a gamut expanded RGB color space and a gamut expanded RGBA color space wherein the gamut expanded color space includes values beyond a visible range of color values; and

labeling an image determined by mapped color values as one of a gamut expanded RGB color space image and a gamut expanded RGBA color space image.

2. (Amended) The method of claim 1 wherein mapping includes, where colors from a selected color space are converted to one of the gamut expanded RGB color space and the

gamut expanded RGBA color space, mapping color data values of a source color space image to color data values of one of the gamut expanded RGB color space and the gamut expanded RGBA color space.

3. (Amended) The method of claim 1 wherein mapping includes, where colors in one of the gamut expanded RGB color space and the gamut expanded RGBA color space are converted to a selected color space, mapping color data values of one of the gamut expanded RGB color space and the gamut expanded RGBA color space to color data values of a destination color space.

4. (Amended) The method of claim 3 wherein, where the color data values in one of the gamut expanded RGB color space and the gamut expanded RGBA color space lie outside a range of the destination color space, mapping includes clipping the color data values for the destination color space.

5. (Amended) The method of claim 3 wherein, where the color data values in one of the gamut expanded RGB color space and the gamut expanded RGBA color space lie outside the range of the destination color space, mapping includes utilizing a predetermined transformation function that maps the color data values to color data values in the selected destination color space.

6. (Amended) The method of claim 1 wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space is linear in visual intensity.

7. (Amended) The method of claim 1 wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space is an XsRGB color space that includes at least the visible range of color values, and where selected, wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes an alpha channel for at least one of: transparency information and opaqueness information.

8. (Amended) The method of claim 1 wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes a color space defined by a gamut that extends into negative component values and beyond 1.0 when normalized to 1.0 in RGB.

9. (Amended) The method of claim 1 wherein mapping the color values to one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes utilizing multiplication of R_0, G_0, B_0 values by a predetermined matrix, where the R_0, G_0, and B_0 values denote normalized numerically linear red, green and blue components for a color value.

15. (Amended) In a digitized image processing system in which an image digitizer outputs digital signals representing an image, a method for providing representation of color images from measured color values in a color management system, comprising the steps of:

mapping the measured color values to a gamut expanded color space wherein the gamut expanded color space includes values beyond a visible range of color values; and

labeling an image determined by the color values mapped to the gamut expanded color space as a gamut expanded color space image.

16. (Amended) The method of claim 15 wherein the gamut expanded color space includes an XsRGB color space defined by a gamut that extends into negative component values and beyond 1.0 when normalized to 1.0 in RGB, and where selected, wherein the expanded RGB/RGBA space includes an alpha channel for at least one of: transparency information and opaqueness information.

23. (Amended) A computer-readable medium having computer-executable instructions for performing the steps of:

mapping the measured color values to a gamut expanded color space wherein the gamut expanded color space includes values beyond a visible range of color values; and

labeling an image determined by the color values mapped to the gamut expanded color space as a gamut expanded color space image.

24. (Amended) In a digitized image processing system in which an image digitizer utilizes color image information to output digital signals representing a color image to an apparatus that uses the digital signals to provide representation of a color image in a color management system, the apparatus comprising:

an expanded color space mapper, for mapping the digital signals to a gamut expanded color space values wherein the gamut expanded color space values include values beyond a visible range of color values; and

an image labeller, coupled to the gamut expanded color space mapper, for labeling an image determined by gamut expanded color space values as a gamut expanded color space image.

25. (Amended) The apparatus of claim 24 wherein the gamut expanded color space includes an XsRGB color space defined by a gamut that extends into negative component values and beyond 1.0 when normalized to 1.0 in RGB, and where selected, wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes an alpha channel for at least one of: transparency information and opaqueness information.

26. (Amended) The apparatus of claim 24 wherein the gamut expanded color space mapper utilizes multiplication of R_0, G_0, B_0 values by a predetermined matrix to map the color values to a gamut expanded color space.

30. (Amended) The apparatus of claim 24 wherein, where color data values have been represented using signed 16 bit values with 13 bits of decimal precision, the gamut expanded color space mapper clips the 16 bit values below 0 and above 8192 to convert the 16 bit values to 8 bit values.

32. (Amended) A computer-readable medium having computer-executable instructions for performing steps comprising:

mapping color values to one of a gamut expanded RGB color space and a gamut expanded RGBA color space wherein the gamut expanded color space includes values beyond a visible range of color values; and

labeling an image determined by mapped color values as one of a gamut expanded RGB color space and a gamut expanded RGBA color space image.

33. (Amended) The computer-readable medium of claim 32 wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes an XsRGB color space that includes at least the visible range of color values, and where selected, wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes an alpha channel for at least one of: transparency information and opaqueness information.

34. (Amended) The computer-readable medium of claim 32 wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes a color space defined by a gamut that extends into negative component values and beyond 1.0 when normalized to 1.0 in RGB.

35. (Amended) The computer-readable medium of claim 32 wherein mapping the color values to one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes utilizing multiplication of R_0, G_0, B_0 values by a predetermined matrix.

41. (Amended) The computer-readable medium of claim 32 wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes an alpha channel for at least one of transparency information and opaqueness information.

42. (Amended) A method of representation of color in images in a color management system using color data values for one of a gamut expanded RGB color space and a gamut expanded RGBA color space, having at least a precision and range sufficient to represent substantially all humanly visible colors substantially without visually perceptible error, the method including the steps of:

representing the color as data values in one of the gamut expanded RGB color space and the gamut expanded RGBA color space wherein the gamut expanded color space includes values beyond a visible range of color values; and

labeling an image determined by the color data values as one of a gamut expanded RGB color space image and a gamut expanded RGBA color space image.

43. (Amended) The method of claim 42 wherein representing includes, where color data values from a selected color space are converted to one of the gamut expanded RGB color space and the gamut expanded RGBA color space, mapping the color data values of a selected image color space to color data values of one of the gamut expanded RGB color space and the gamut expanded RGBA color space.

44. (Amended) The method of claim 42 wherein representing includes, where color data values in one of the expanded RGB color space and the gamut expanded RGBA color space are converted to a selected color space, mapping the color data values of one of the gamut expanded RGB color space and the gamut expanded RGBA color space to a selected destination color space.

45. (Amended) The method of claim 44 wherein, where the perceptually visible data values lie outside a predetermined range, the mapping includes clipping the color data values to a range of the selected destination color space.

46. (Amended) The method of claim 44 wherein the mapping includes utilizing a predetermined transformation function that maps the color data values to color data values in the selected destination color space.

47. (Amended) The method of claim 42 wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space is linear in visual intensity.

48. (Amended) A method for representing color images in a color management system in one of a gamut expanded RGB color space and a gamut expanded RGBA color space wherein the gamut expanded color space includes values beyond a visible range of color values and further representing at least one of super transparent and super opaque colors using an alpha channel, comprising the steps of:

representing color data values as perceptually visible super transparent/super opaque data values in a color space; and

labeling an image determined by the perceptually visible super transparent/super opaque data values as a super transparent/super opaque color space image.

49. (Amended) The method of claim 1 wherein color operations defined in one of the gamut expanded RGB color space and the gamut expanded RGBA color space are extended to one of the gamut expanded RGB color space and the gamut expanded RGBA color space.

50. (Amended) The method of claim 48 wherein the alpha channel extends less than 0 and beyond 1.0 when normalized to 1.0.

51. (Amended) A method of representing gamut expanded color data values in images in a color management system using color data as appearance RGB values, comprising the steps of:

representing the gamut expanded color data values as normalized RGB values wherein each normalized RGB value (R_w, G_w, B_w) is obtained using a predetermined transformation matrix that is based on a preselected spectrum distribution; and

labeling agamut expanded color space image determined by the normalized RGB values as an appearance match image for corresponding X, Y, and Z values in accordance with 1931 Commission Internationale de l'Eclairage where Y has been normalized to 1.

52. (Amended) A device for representing gamut expanded color data values in images in a color management system using color data as appearance RGB values, comprising:

an expanded color space mapper, arranged to represent the gamut expanded color data values as normalized RGB values wherein each normalized RGB value (R_w, G_w, B_w) is obtained using a predetermined transformation matrix that is based on a preselected spectrum distribution; and

an image labeller, for labeling a gamut expanded color space image determined by the normalized RGB values as an appearance match image for corresponding X, Y, and Z values in accordance with 1931 Commission Internationale de l'Eclairage where Y has been normalized to 1.

53. (Amended) A method of representing gamut expanded color data values in images using color data as absolute RGB values, comprising the steps of:

representing the gamut expanded color data values as absolute RGB values wherein each absolute RGB value (R_0, G_0, B_0) is obtained using a predetermined transformation matrix that is based on a standard 1931 Commission Internationale de l'Eclairage D65 spectrum distribution; and

labeling a gamut expanded color space image determined by the absolute RGB values as an absolute match image for corresponding X, Y, and Z values in accordance with 1931 Commission Internationale de l'Eclairage where Y has been normalized to 1.

54. (Amended) A device for representing gamut expanded color data values in images using color data as absolute RGB values, comprising:

an color space mapper, arranged to represent the gamut expanded color data values as absolute RGB values wherein each absolute RGB value (R_0, G_0, B_0) is obtained using a predetermined transformation matrix that is based on a standard 1931 Commission Internationale de l'Eclairage D65 spectrum distribution;

an image labeler for labeling a gamut expanded color space image determined by the absolute RGB values as an absolute match image for corresponding X, Y, and Z values in accordance with 1931 Commission Internationale de l'Eclairage where Y has been normalized to 1.

REMARKS

The Office Action mailed April 4, 2002 has been received and it contents carefully considered. Claims 1 - 54 are currently pending in the application. The drawings have been deemed acceptable subject to correction of the informalities noted by the Official Draftsman. Formal drawings correcting the informalities are being filed concurrently herewith.

Claims 1 - 14, 25, 32 - 47 and 49 are rejected under 35 U.S.C. § 112, first paragraph as containing subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains. The specification and Claims 1 - 14, 16, 25, 32 - 47 and 49 have been amended where appropriate to overcome the rejection.

Claim 23 has been rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter, which applicant regards as the invention. Claim 23 has been amended to overcome the rejection.

Claims 1 - 9, 14 - 17, 22 - 26, 31 - 35 and 40 - 50 are rejected under 35 U.S.C. § 102 (e) as being anticipated by U.S. Patent No. 5,946,113 Pritchett (hereinafter "Pritchett"). Claims 11 - 13, 19 - 21, 28 - 30 and 37 - 39 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Pritchett. Applicants respectfully traverse these rejections.

The Action alleges that Pritchett shows all the features of independent claim 1. To show the steps of mapping and labeling, the action relies on element 135 of Fig. 1 and Fig. 4.

Claim 1, as amended, is as follows:

> A method for providing a color space representation of color images in a color management system, comprising the steps of:
> mapping color to color data values in one of a gamut expanded RGB color space and a gamut expanded RGBA color space wherein the gamut expanded color space includes values beyond a visible range of color values; and
> labeling an image determined by mapped color values as one of a gamut expanded RGB color space image and a gamut expanded RGBA color space image. (emphasis added)

In contrast to Pritchett, the method of amended claim 1 is directed to providing a color space representation of color images in a color management system.

The Office Action contends that Pritchett describes a computer-readable medium for the purpose of providing high quality, substantially error-free color in images, having

> computer-executable instructions for performing the steps of mapping measured color values to an expanded RGB color space ... wherein the expanded RGB color space includes values beyond a visible range of color values, and labeling an image determined by the color values mapped to that expanded RGB color space as an expanded RGB color space.

In fact, Pritchett describes at col. 3, lines 33 - 36, a

> system and method for converting a color represented in a first color space into a corresponding color represented in an extended version of a second color space.

The solution offered by Pritchett is limited to a transformation/conversion between YCrCb and RBG colorspaces and for the purpose of viewing video images on a computer display. There is

no suggestion or teaching in Pritchett that the transformation/conversion applies to a color management system as called for in amended independent claim 1.

Further, amended independent claim 1 recites, among other features, mapping a gamut expanded color space and labeling a gamut expanded color space image, where a gamut expanded color space is larger than the visible color space. In stark contrast, the system and method described by Pritchett merely increases precision. That is, at col. 4, line 59 to col. 5, line 29, Pritchett describes a conversion between color ranges of color spaces. In particular at col. 6, lines 7 – 22, Pritchett states that

> Extended RGB color space 330 is identical to RGB color space 230 except for an increase in the valid range of components of extended RGB color space 330 ... In other words, extended RGB color space 330 provides additional headroom (as compared with RGB color space 230) to accommodate the entire dynamic range of valid colors in the original color space. (emphasis added)

That is, the valid range of colors is necessarily the visible colors and the range is simply increased to provide additional headroom. In other words, Pritchett describes a system where the conversion is carried out for the valid (visible) range of colors and merely increases the precision by increasing the number of fractional bits. The conversion between color spaces encompasses the range of valid (visible) colors. Pritchett neither teaches nor suggests that there is any mapping to a gamut expanded color space, wherein the gamut expanded color space includes values beyond a visible range of color values as recited in Claim 1. At col. 5, lines 61 – 63 conversion of a valid color in a first color space always results in a valid color in the extended color space.

For at least all of the above reasons, it is respectfully submitted that Claim 1 of the present invention is not anticipated by Pritchett and is, therefore, patentable over the art of record. Independent claims 15, 24, 32, 42 and 48 also all recite either the step of mapping to a

gamut expanded color space and labeling a gamut expanded color space image or an expanded color space mapper for mapping a gamut expanded color space and an image labeler for labeling a gamut expanded color space image. Therefore, for at least the reasons above, claims 15, 24, 32, 42 and 48 are also not anticipated by Pritchett and are, therefore, patentable over the art of record.

Claims 2 - 14 and 49 recite additional features and depend directly or indirectly from Claim 1. Claims 16 - 22 recite additional features and depend directly or indirectly from Claim 15. Claims 25 - 31 recite additional features and depend directly or indirectly from Claim 24. Claims 33 - 41 depend directly from Claim 32 and recite additional features. It is, therefore, submitted for the same reasons set forth above with respect to claims 1, 15, 24, 32, 42 and 48 that each of the aforementioned claims is unanticipated and patentable over the art of record.

Claim 32 further recites the use of computer executable instructions stored on computer readable media for performing the steps of mapping a gamut expanded color space and labeling a gamut expanded color space image. Even assuming, but not admitting that Pritchett shows the steps of mapping and labeling, claim 32 is still patentably distinct from Pritchett. Notably, Pritchett does not describe or suggest that its transformation or conversion process uses computer executable instructions stored on a computer readable medium as called for in claim 32. Referring to col. 4, lines 27 - 40, the transformations in Pritchett are performed by the video decoder and video encoder. Specifically at col. 4, lines 35 - 40,

> the video decoder 120 **must** convert a color of a pixel represented in ... Conversely, video encoder 140 **must** convert a color of a pixel represented in ... (emphasis added)

Thus, Pritchett does not describe computer-readable media or have computer-executable instructions for the transformation or conversion process. Rather, as described at col. 4, lines 4 – 14 of Pritchett, the computer system and software applications stored thereon are for

enhancement, sharpening, blurring etc. rather than color space conversion. The video decoder and the video encoder are outside of the computer system depicted in Fig. 1 of Pritchett. The color space converter 400 of Fig. 4 of Pritchett must, therefore, be contained within the video decoder and video encoder and not within the computer system 130 of Fig. 1. For this further reason, claim 32 is patentably different from Pritchett as are claims 33-41, which depend from claim 32. Similarly, Claims 51 and 53 recite the steps of mapping and labeling and have been similarly amended to more particularly point out and distinctly claim the invention. Namely, these claims call for representing a gamut expanded color data values and labeling a gamut expanded color space image. For at least the reasons discussed above, Claims 51 and 53 are also respectfully submitted to be unanticipated and patentable over the art of record. Claims 52 and 54 recite an expanded color space mapper for representing a gamut expanded color space and an image labeler for labeling a gamut expanded color space image and have thus been similarly amended to more particularly point out and distinctly claim the invention. For at least the reasons discussed above, Claims 52 and 54 are also respectfully submitted to be unanticipated and patentable over the art of record.

Claims 10, 18, 27, 36 and 51 - 54 have been rejected under 35 U.S.C. § 103 (a) as being unpatentable over Pritchett, as applied to Claims 15, 24, 32 and 51 - 54 in view of Stokes and U.S. Patent No. 5,502,580 by Yoda et al. (hereinafter "Yoda"). Applicants respectfully traverse the rejection.

Yoda discloses that the YCC color scheme can be uniquely converted to the XYZ color scheme mathematically. Stokes describes a transformation matrix for converting 1931 CIE XYZ color space data to RGB color space data where Y has been normalized to 1.

Neither Yoda nor Stokes alone or in combination overcome the deficiencies of Pritchett. For all of the above reasons, it is respectfully submitted that Claims 1, 15, 24, 32 and 51 - 54 and their respective dependent claims are novel and non-obvious over Pritchett in combination with Yoda and/or Stokes.

In view of the foregoing and for at least the above reasons, it is submitted that claims 1 – 54 are patentable over the art of record and that the application is in condition for allowance. Applicants respectfully request reconsideration and withdrawal of the objection and the rejections.

Should the Examiner believe a conference would advance the prosecution of the application, the Examiner is encouraged to telephone the undersigned counsel to arrange such a conference.

Respectfully submitted,

_____

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Dated: May 20, 2002

MARKED-UP VERSION OF AMENDMENT

IN THE SPECIFICATION:

Please amend the paragraph beginning on page 3, line 22 as follows:

The present invention provides an apparatus, method and computer-readable medium for converting digital signals for a color image into high quality error-free expanded color space color images. A normalized RGB color space is defined for color values from 0 to 1. An expanded RGB~~/~~ or an expanded RGBA or expanded sRGB~~/~~ or an expanded sRGBA color space is defined herein to include color values below 0 and/or greater than 1. By extending the color space, the present invention eliminates the need for users to "clamp" color information into the predetermined range than are needed to fully describe the color. For example, where color data information is limited to an-8 bit range of 0 to 255, and a color value of 300 is obtained, data may be "clamped" into the range of 0 to 255, causing color data loss and distortion.

Please amend the paragraph beginning on page 4, line 8 as follows:

In one embodiment, the method includes obtaining color values; mapping the color values to one of: an expanded RGB~~/~~ or an expanded RGBA or an expanded sRGB~~/~~ or an expanded sRGBA space; and labeling an image determined by mapped color values as an expanded RGB/RGBA or expanded sRGB/sRGBA color space image. The expanded RGB~~/~~ or the expanded RGBA or sRGB~~/~~ or SRGBA space may include at least the visible range of color values. Also, the expanded RGB~~/~~ or the expanded RGBA or sRGB~~/~~ or SRGBA space may be described as a color space defined by a chromaticity diagram that extends into negative component values and beyond 1.0 when normalized to 1.0 in RGB or sRGB, respectively. With respect to terminology, as used herein, "RGB/RGBA" is defined to be interchangeable with the terms "RGB~~/~~ or ARGB" or "RGB~~/~~ or RGB(A)". That is, there is no distinction between the

recited terms, and no specific ordering of elements is indicated by the terminology. Further, as used herein, "RGB/RGBA" is to be interpreted as RGB or RGBA; expanded RGB/RGBA" is to be interpreted as expanded RGB or expanded RGBA; and "expanded SRGB/SRGBA" is to be interpreted as expanded SRGB or expanded SRGBA. In the alternative, any of the above terms may be expressed and interpreted as "one of x or y". For example, "expanded RGB/RGBA" may be equivalently expressed as "one of an expanded RGB and an expanded RGBA."

Please amend the paragraph beginning on page 19, line 10 as follows:

3. Image convolution operations. For example, a blur filter matrix M is given by:

1/16	1/8	1/16
1/8	1/4	1/8
1/16	1/8	1/16

The blur equation is for each color component. Assuming a RGB color component of a pixel at location (i,j) is C(i,j), the resulting RGB color component of the pixel after the blur operation is given by:

$$(1/16)C(i-1, j-1) + (1/8)C(i-1, j) + (1/16)C(i-1, j+1) +$$
$$(1/8)C(i, j-1) + (1/4)C(i,j) + (1/8)C(i, j+1) +$$
$$(1/~~6~~16)C(i+1, j-1) + (1/8)C(i+1, j) + (1/16)C(i+1, j+1)$$

IN THE CLAIMS:

Please amend the following claims:

1. (Amended) A method for providing a color space representation of ~~high quality, substantially visually error-free~~ color ~~in~~ images in a color management system, comprising the steps of:

mapping color to color data values in one of ~~an~~ gamut expanded RGB color space and a gamut expanded /RGBA color space wherein the gamut expanded color space includes values beyond a visible range of color values; and

labeling an image determined by mapped color values as one of ~~an~~ gamut expanded RGB color space image and a gamut expanded /RGBA color space image.

2. (Amended) The method of claim 1 wherein mapping includes, where colors from a selected color space are converted to one of the gamut expanded RGB color space and the gamut expanded /RGBA color space, mapping color data values of a source color space image to color data values of one of the gamut expanded RGB color space and the gamut expanded /RGBA color space.

3. (Amended) The method of claim 1 wherein mapping includes, where colors in one of the gamut expanded RGB color space and the gamut expanded /RGBA color space are converted to a selected color space, mapping color data values of one of the gamut expanded RGB color space /and the gamut expanded RGBA color space to color data values of a destination color space.

4. (Amended) The method of claim 3 wherein, where the color data values in one of the gamut expanded RGB color space and the gamut expanded /RGBA color space lie outside a range of the destination color space, mapping includes clipping the color data values for the destination color space.

5. (Amended) The method of claim 3 wherein, where the color data values in one of the gamut expanded RGB color space and the gamut expanded ~~/~~RGBA color space lie outside the range of the destination color space, mapping includes utilizing a predetermined transformation function that maps the color data values to color data values in the selected destination color space.

6. (Amended) The method of claim 1 wherein one of the gamut expanded RGB color space and the gamut expanded ~~/~~RGBA color space is linear in visual intensity.

7. (Amended) The method of claim 1 wherein one of the gamut expanded RGB color space and the gamut expanded ~~/~~RGBA color space is an XsRGB color space that includes at least the visible range of color values, and where selected, wherein one of the gamut expanded RGB color space and the gamut expanded ~~/~~RGBA color space includes an alpha channel for at least one of: transparency information and opaqueness information.

8. (Amended) The method of claim 1 wherein one of the gamut expanded RGB color space and the gamut expanded ~~/~~RGBA color space includes a color space defined by a gamut that extends into negative component values and beyond 1.0 when normalized to 1.0 in RGB.

9. (Amended) The method of claim 1 wherein mapping the color values to one of ~~an~~the gamut expanded RGB color space and the gamut expanded ~~/~~RGBA color space includes

utilizing multiplication of R_0, G_0, B_0 values by a predetermined matrix, where the R_0, G_0, and B_0 values denote normalized numerically linear red, green and blue components for a color value.

15. (Amended) In a digitized image processing system in which an image digitizer outputs digital signals representing an image, a method for providing representation of ~~high quality, substantially visually error free~~ color images from measured color values in a color management system, comprising the steps of:

mapping the measured color values to ~~an~~ gamut expanded color space wherein the gamut expanded color space includes values beyond a visible range of color values; and

labeling an image determined by the color values mapped to the gamut expanded color space as ~~an~~ gamut expanded color space image.

16. (Amended) The method of claim 15 wherein the gamut expanded color space includes an XsRGB color space defined by a gamut that extends into negative component values and beyond 1.0 when normalized to 1.0 in RGB, and where selected, wherein the expanded RGB/RGBA space includes an alpha channel for at least one of: transparency information and opaqueness information.

23. (Amended) A computer-readable medium having computer-executable instructions for performing the steps of:

~~recited in claim 15.~~ mapping the measured color values to a gamut expanded color space wherein the gamut expanded color space includes values beyond a visible range of color values; and

labeling an image determined by the color values mapped to the gamut expanded color space as a gamut expanded color space image.

24. (Amended) In a digitized image processing system in which an image digitizer utilizes color image information to output digital signals representing a color image to an apparatus that uses the digital signals to provide representation of a ~~a high quality visually error free expanded colorspace~~ color image in a color management system, the apparatus comprising:

an expanded color space mapper, for mapping the digital signals to a gamut expanded color space values wherein the gamut expanded color space values include values beyond a visible range of color values; and

an image labeller, coupled to the gamut expanded color space mapper, for labeling an image determined by gamut expanded color space values as ~~an~~ gamut expanded color space image.

25. (Amended) The apparatus of claim 24 wherein the gamut expanded color space includes an XsRGB color space defined by a gamut that extends into negative component values and beyond 1.0 when normalized to 1.0 in RGB, and where selected, wherein one of the gamut expanded RGB color space and the ~~/~~gamut expanded RGBA color space includes an alpha channel for at least one of: transparency information and opaqueness information.

26. (Amended) The apparatus of claim 24 wherein the gamut expanded color space mapper utilizes multiplication of R_0, G_0, B_0 values by a predetermined matrix to map the color values to a gamut~~s~~ expanded color space.

30. (Amended) The apparatus of claim 24 wherein, where color data values have been represented using signed 16 bit values with 13 bits of decimal precision, the gamut expanded color space mapper clips the 16 bit values below 0 and above 8192 to convert the 16 bit values to 8 bit values.

32. (Amended) A computer-readable medium having computer-executable instructions for performing steps comprising:

mapping color values to one of ~~an~~ gamut expanded RGB color space and a gamut expanded /RGBA color space wherein the gamut expanded color space includes values beyond a visible range of color values; and

labeling an image determined by mapped color values as one of ~~an~~ gamut expanded RGB color space and a gamut expanded /RGBA color space image.

33. (Amended) The computer-readable medium of claim 32 wherein one of the gamut expanded RGB color space /and the gamut expanded RGBA color space includes an XsRGB color space that includes at least the visible range of color values, and where selected, wherein one of the gamut expanded RGB color space and the gamut expanded /RGBA color space includes an alpha channel for at least one of: transparency information and opaqueness information.

34. (Amended) The computer-readable medium of claim 32 wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes a color space defined by a gamut that extends into negative component values and beyond 1.0 when normalized to 1.0 in RGB.

35. (Amended) The computer-readable medium of claim 32 wherein mapping the color values to one of ~~a then~~ gamut expanded RGB color space and the gamut expanded RGBA color space includes utilizing multiplication of R_0, G_0, B_0 values by a predetermined matrix.

41. (Amended) The computer-readable medium of claim 32 wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space includes an alpha channel for at least one of transparency information and opaqueness information.

42. (Amended) A method of representation of color in images in a color management system using color data values for one of ~~an~~ gamut expanded RGB color space and a gamut expanded RGBA color space, having at least a precision and range sufficient to represent substantially all humanly visible colors substantially without visually perceptible error, the method including the steps of:

representing the color as data values in one of ~~a then~~ gamut expanded RGB color space and the gamut expanded RGBA color space wherein the gamut expanded color space includes values beyond a visible range of color values; and

labeling an image determined by the color data values as one of ~~an~~ gamut expanded RGB color space image and a gamut expanded /RGBA color space image.

43. (Amended) The method of claim 42 wherein representing includes, where color data values from a selected color space are converted to one of the gamut expanded RGB color space and the gamut expanded /RGBA color space, mapping the color data values of a selected image color space to color data values of one of the gamut expanded RGB color space and the gamut expanded /RGBA color space.

44. (Amended) The method of claim 42 wherein representing includes, where color data values in one of the expanded RGB color space and the gamut expanded /RGBA color space are converted to a selected color space, mapping the color data values of one of the gamut expanded RGB color space/ and the gamut expanded RGBA color space to a selected destination color space.

45. (Amended) The method of claim 44 wherein, where the perceptually visible data values lie outside a predetermined range, the mapping includes clipping the color data values to a range of the selected destination color space.

46. (Amended) The method of claim 44 wherein the mapping includes utilizing a predetermined transformation function that maps the color data values to color data values in the selected destination color space.

47. (Amended) The method of claim 42 wherein one of the gamut expanded RGB color space and the gamut expanded RGBA color space is linear in visual intensity.

48. (Amended) A method for representing color images in a color management system in one of a gamut expanded RGB color space and a gamut expanded RGBA color space wherein the gamut expanded color space includes values beyond a visible range of color values and further representing at least one of super transparent and super opaque colors using an alpha channel, comprising the steps of:

representing color data values as perceptually visible super transparent/super opaque data values in a color space; and

labeling an image determined by the perceptually visible super transparent/super opaque data values as a super transparent/super opaque color space image.

49. (Amended) The method of claim 1 wherein color operations defined in one of the gamut expanded RGB color space and the gamut expanded RGBA color space are extended to one of ~~a~~the gamut expanded RGB color space and the gamut expanded RGBA color space.

50. (Amended) The method of claim 48 wherein the alpha channel extends less than 0 and beyond 1.0 when normalized to 1.0.

51. (Amended) A method of representing gamut expanded color data values in images in a color management system using color data as appearance RGB values, comprising the steps of:

representing the gamut expanded color data values as normalized RGB values wherein each normalized RGB value (R_w, G_w, B_w) is obtained using a predetermined transformation matrix that is based on a preselected spectrum distribution; and

labeling ~~an~~gamut expanded color space image determined by the normalized RGB values as an appearance match image for corresponding X, Y, and Z values in accordance with 1931 Commission Internationale de l'Eclairage where Y has been normalized to 1.

52. (Amended) A device for representing gamut expanded color data values in images in a color management system using color data as appearance RGB values, comprising:

an expanded color space mapper, arranged to represent the gamut expanded color data values as normalized RGB values wherein each normalized RGB value (R_w, G_w, B_w) is obtained using a predetermined transformation matrix that is based on a preselected spectrum distribution; and

an image labeller, for labeling ~~an~~ gamut expanded color space image determined by the normalized RGB values as an appearance match image for corresponding X, Y, and Z values in accordance with 1931 Commission Internationale de l'Eclairage where Y has been normalized to 1.

53. (Amended) A method of representing gamut expanded color data values in images using color data as absolute RGB values, comprising the steps of:

representing the gamut expanded color data values as absolute RGB values wherein each absolute RGB value (R_0, G_0, B_0) is obtained using a predetermined transformation matrix that is

based on a standard 1931 Commission Internationale de l'Eclairage D65 spectrum distribution; and

labeling ~~an~~ gamut expanded color space image determined by the absolute RGB values as an absolute match image for corresponding X, Y, and Z values in accordance with 1931 Commission Internationale de l'Eclairage where Y has been normalized to 1.

54. (Amended) A device for representing gamut expanded color data values in images using color data as absolute RGB values, comprising:

~~representing the~~an color space mapper, arranged to represent the gamut expanded color data values as absolute RGB values wherein each absolute RGB value (R_0, G_0, B_0) is obtained using a predetermined transformation matrix that is based on a standard 1931 Commission Internationale de l'Eclairage D65 spectrum distribution;

an image labeler for labeling ~~an~~ gamut expanded color space image determined by the absolute RGB values as an absolute match image for corresponding X, Y, and Z values in accordance with 1931 Commission Internationale de l'Eclairage where Y has been normalized to 1.